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Paper Abstract

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Paper Title: Microwave Antenna Holography System

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Description:

This paper describes the design, implementation and demonstration of a portable Microwave Antenna Holography System (MAHST). Microwave antenna holographic metrology is a key technique for diagnostics, analysis, and performance improvement of large reflector and beamwaveguide antennas. The MAHST provides: performance improvement by applying high resolution and high precision antenna imaging with standard deviation of 100-microns and panel adjustment accuracy of 10-20-microns; far-field amplitude and phase pattern measurement; aperture amplitude and phase functions; quick diagnostics, analysis, and performance maintenance to current specifications including subreflector position correction; gravity distortion characterization and analysis; and directivity computation at other frequencies. Currently, no known such system is commercially available.

The JPL MAHST utilizes beacon signals from geosynchronous satellites as convenient far-field sources for the holographic measurements. A small reference antenna, a receiver, data acquisition computer and interfaces and data processing comprises the MAHST. The portable MAHST can be shipped to any antenna around the world and easily interfaced with its encoders and antenna drive systems. The paper describes recent holographic measurements of the NASA/JPL 34-meter beamwaveguide antenna (DSS-13). The performance improvement to DSS-13 by holography is estimated at 4.7-dB at Ka-band (32-GHz), by reducing the rms surface error from 0.88-mm to 0.31-mm in three separate sessions. The third successful holographic measurement of DSS-13 included unbending of those panels that were manufactured to the wrong contour as well as setting of all the other panels. The performance improvement was verified by independent efficiency measurements.